

Methods of Quantifying VOCs for Air Permitting and Calculating Operating Fees

**Subcommittee on VOCs
State Advisory Board on Air Pollution**

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List of Acronyms

FID – Flame Ionization Detector

Hg – Mercury

MACT – Maximum Achievable Control Technology

MSW – Municipal Solid Waste

NAAQS – National Ambient Air Quality Standards

NO_x – Nitrogen Oxides

NSPS – New Source Performance Standards

PSD – Prevention of Significant Deterioration

SIP – State Implementation Plan

VOC – Volatile Organic Compound

EXECUTIVE SUMMARY

The purpose of the VOC subcommittee of the State Advisory Board on Air Pollution, was to evaluate alternative methods for quantifying VOCs (volatile organic compounds) and recommend which methods should be used for air permitting and for calculation of air operating fees. The sub-committee members reviewed the different methods for determining VOCs in mixtures emitted from regulated sources. They examined the rules and practices currently in place in Virginia and in other states, regarding permits and permitting fees for specific mixes of VOCs from regulated sources. They evaluated the pros and cons of different methods of quantifying VOCs in relation to PSD permitting and calculation of air operating fees for regulated sources.

The subcommittee found that, there is a wide range of approaches to VOC testing in use by various states. VOC test results are used for a variety of purposes, namely emission fees, new source review applicability, and compliance with permit limits and control efficiencies. Most permits do not specify VOC test methodology for purposes of demonstrating compliance with VOC limits. There are inconsistencies and lack of guidance among states and EPA regions in implementation of VOC test methodology. Due to the wide range of industries and types of emissions from sources within an industry, it is technically difficult to specify any one single method (out of the many EPA approved methods) for VOC measurement.

It is recommended that VADEQ adopt the Pennsylvania state guidance for quantifying VOCs as stated in that state's November 2000 Source Testing Manual. Such a move should provide consistent guidance for VADEQ to regulate VOCs in Virginia, yet allow for flexibility between industries when choosing a surrogate parameter for VOCs.

The subcommittee also recommends that the VOC compliance methodology be incorporated in all air permits in order to protect both the source and DEQ in compliance certifications. In addition, it would be beneficial if VADEQ develop a database on their web page listing (by industries) all surrogate parameters chosen for VOC reporting, to assure consistency across industries and VADEQ regional offices.

INTRODUCTION AND PURPOSE

VOCs is short for "Volatile Organic Compounds". Many VOCs are hydrocarbons meaning organic compounds that contain only carbon and hydrogen. However, USEPA defines VOCs to include organic non-hydrocarbons containing oxygen, nitrogen, sulfur, and halogens in addition to carbon and hydrogen. Since 1992, this basic EPA definition of VOCs has not changed.

Photochemical reactivity of VOC emissions contributes to levels of ambient atmospheric ozone. Ozone formation results from complex reactions involving nitrogen oxides (NO_x) and VOCs that occur in the lower atmosphere in the presence of sunlight. Ozone production is the primary reason why atmospheric VOC emissions are regulated. The photochemical reactivity of a VOC is the criterion used for deciding whether it should be regulated. Reducing levels of ozone and other photochemical oxidants implies controlling reactive VOC emissions.

The 1990 Clean Air Act Amendments contained provisions for dealing with continuing non-attainment of the ambient air quality for ozone, including mandatory revision of SIPs and issuance of additional VOC and NO_x control guidelines for existing sources. Currently, states have primary responsibility for permitting and limiting VOC emissions. Permitting requirements fall under a variety of regulatory programs for ozone and VOCs, including NAAQS, NSPS, PSD, Title V, MACT etc.

Many VOC permitting requirements under these programs are dependent on a facility's annual emissions, or on the increase in annual emissions resulting from projects where equipment is modified or added at an existing facility. The main permitting requirements are associated with EPA's programs for Prevention of Significant Deterioration of Air Quality (PSD), new source review in non-attainment areas, and the relatively new Title V operating permits. For all of these permitting programs, annual VOC emissions govern what provisions apply to a facility, or to modifications of a facility. Applicability thresholds range from 10 to 250 tons per year, with amounts under 100 tons generally applying in ozone non-attainment areas.

Permitting and enforcement of VOC emissions necessitate measurement and reporting of VOCs in the emission gas streams. The majority of VOC testing used for air permitting and for calculation of air operating fees are conducted using one of three EPA methods namely, Method 18, Method 25, or Method 25A. Method 18 is based on gas chromatography and reports results in terms of the concentration of specific VOC compounds. However, it appears that there is no consistency at the state level with respect to the reporting of VOC emission rates when Methods 25, 25A, and other related methods are used for testing.

In order to convert Method 25 results to a VOC mass emission rate, it is necessary to know the VOC-to-carbon weight ratio for the mixture of organic compounds in the gas stream tested. The reason for this requirement is that Method 25 gives results expressed in terms of carbon, since all of the VOC in the gas stream sample is converted to methane prior to being quantified with a flame ionization detector (FID). Because of this conversion to methane during the analysis, Method 25 provides a one-to-one response for all the carbon atoms in the sample.

In Method 25A, the gas stream samples are introduced directly to a FID, and results are expressed in terms of the gas used to calibrate the FID (usually methane or propane). Because

some organic compounds containing atoms such as chlorine or oxygen may cause a depressed or an elevated response on the FID, Method 25A does not necessarily provide a one-to-one response for all of the carbon atoms present in the sample. Therefore, the relative response factor between the organic compounds in the gas stream and the gas used to calibrate the Method 25A, must be taken into account when converting Method 25A results to a VOC mass emission rate.

Method 25 and 25A results must be converted to an “as VOC” basis if emission rates are being calculated in order to determine compliance, determine rule applicability, or establish fees based upon VOC emission rates. In order to convert Method 25 or 25A results to an “as VOC” basis, it is necessary to have some knowledge regarding the relative concentration of the various organic compounds in the gas phase. In some situations, there are potential ways of simplifying or streamlining the calculation of VOC mass flow rates for gas streams that contain a complex mixture of VOCs. For example, some gas streams may contain compounds whose VOC-to-carbon weight ratios are similar enough that a representative average ratio can be chosen for use in the calculation without actually knowing the precise concentration of each compound in the gas stream. In other situations, it may be possible to show that emissions are below a relevant emission rate standard or rule applicability threshold even if the “worst case” VOC-to-carbon weight ratio for all of the compounds in the gas stream, has been used to convert carbon emission rates to VOC emission rates. In such situations, therefore, it would not be necessary to know the exact concentration of each compound in the gas stream. Obviously, in situations where a complex mixture of VOCs is present in a gas stream, calculating an average VOC-to-carbon weight ratio can be somewhat arbitrary. The Appendix provides a summary of selected regulatory VOC testing requirements for various industries.

There is no official VADEQ guidance on the matter of accepting “as carbon” test results to meet lb/hr permit limits. VADEQ has not traditionally accepted measurement of VOCs as carbon for purposes of meeting permit limits. “As carbon” test results require some sort of correction when such results are reported for compliance purposes. Whether or not the resulting calculation formula is correct, is correctly applied, and is consistently applied across the state for determining regulatory program applicability and annual emission estimates is not yet determined. For calculating permit fees, and for emission calculations associated with permitting, VADEQ needs an accurate representation of VOC emissions.

The purpose of the VOC subcommittee of the State Advisory Board on Air Pollution, was to evaluate alternative methods for quantifying VOCs and recommend which methods should be used for air permitting and for calculation of air operating fees.

Specifically:

- a. Research different methods for determining VOCs in mixtures emitted from regulated sources;
- b. Find out what rules and practices are currently in place in Virginia and in other states, regarding permits and permitting fees for specific mixes of VOCs (volatile organic compounds) from regulated sources;

c. Research Federal and State regulations regarding permitting, permit fees, and definitions for VOCs from regulated sources; and

VOC QUANTIFICATION METHODOLOGIES

In practice, VOC emissions can be determined by either estimation using mass balance calculations, engineering analyses and control techniques guidelines or by direct quantification by stack test methods. We will consider the stack test method of quantification in the remainder of this report.

The measurement of VOCs is performed by detecting the concentration of VOC at the emission point. VOC measurement requires a test method that is capable of detecting the presence of a wide variety of gaseous organic compounds. Each of these compounds may have a different calibration factor with the detector used by the method. Some methods attempt to calibrate for and measure each VOC present while other methods measure all VOCs together and report the result in terms of a calibration gas or as carbon.

The measurement of VOC emissions is complicated in practice by the inherent inconsistencies between the regulatory methods used. It should be noted that VOC test methods are needed for determining compliance with NSPS, NESHAP and MACT emission requirements, control device efficiencies, and VOC concentrations (or mass emission rates) for permit limit and/or permit fee calculations. Most VOC testing is conducted using one of the following three EPA methods. These methods vary considerably in sensitivity, accuracy, ease of use and cost.

Method 18 utilizes gas chromatography to separate the VOC compounds from each other and from other interferences in the gaseous stream. The detector used in this method is specifically calibrated for each VOC compound present using known standards to develop response factors and linear operating ranges for the method. This method is capable of providing true results in terms of individual VOC components which when totaled provide a total VOC concentration. The test method operator must be skilled in the use of gas chromatographic methods and may often need to perform preliminary screening analyses on effluent gas streams where the composition and concentration ranges are initially poorly characterized. The cost of using Method 18 is generally much higher than alternative methods. The main advantage of this method is that results are reported “as VOC”.

Method 25 measures TGNMO (total gaseous non-methane organic) by first separating the VOC components from methane, carbon monoxide and carbon dioxide. The remaining VOC compounds are chemically converted to methane molecules, which are quantitatively measured by a FID (flame ionization detector). This method provides a measurement of the VOC composition in terms of its carbon content. This method normalizes the response factor for individual VOC components since the carbon in each component is converted to methane before performing the quantification. This method has detection limit of about 50 ppm carbon and cannot be used on many control device outlets where the concentration is often considerably less than that. This method reports VOC “as Carbon”.

Method 25A is an instrumental method in which the VOC is introduced to a FID without first separating the VOC components. The FID is calibrated with a standard gas such as methane or propane and the method results are often reported in terms of the calibration gas used (e.g., “as propane”). The main problem with this method is the variation of the FID response to VOC components other than hydrocarbon compounds. VOC compounds containing oxygen or halogen atoms may differ as much as two-fold in FID response from similar hydrocarbon compounds. This method is sensitive to low concentrations, relatively easy to use, low cost and may be converted to “as VOC” results for simple gas streams where the composition is known. For complicated or variable gas streams, it may vary widely from Method 18 or Method 25 results. EPA advises Method 25A is applicable for the determination of total gaseous organic concentrations consisting primarily of aromatic and straight chain hydrocarbon compounds.

The equipment needed to measure VOC as propane (Method 25A) is considerably less expensive than the GC methods, and the test is easier to run than Methods 18 (as VOC) or 25 (as carbon). The value of method 25A for reducing cost is one of the main reasons EPA had for approving Method 25A.

CURRENT EPA POLICIES AND GUIDANCE ON VOCs

EPA Policies Relating to VOCs: EPA has been regulating VOCs since 1970 due to their role in ozone formation. EPA’s approach to quantifying and reporting VOCs has changed over the years with the evolution of more sophisticated test methods, but not necessarily at the same pace or in the same manner as the policies and regulations. This is the main reason for the current uncertainty as to how VOC emissions should be measured (or estimated) and reported by facilities under different EPA and state regulatory programs (see Appendix). Even today, the States differ in their approaches to regulating VOCs. Below is a brief history of the EPA policies relating to VOCs over time.

Formation of photochemical oxidants was first identified in studies in Southern California in the 1960’s. Nitrogen oxides (NO_x) and reactive organic compounds, combined with sunlight and poor dispersion conditions were found to be the basic elements causing ozone formation. The first limits on emissions of volatile organic compounds were in the Los Angeles and San Francisco areas in the late 1960’s.

After its formation in 1970, EPA promulgated a National Ambient Air Quality Standards for photochemical oxidants (ozone) and non-methane hydrocarbons. The “Reference Method for Determination of Hydrocarbons Corrected for Methane” adopted by EPA in 1971 used a hydrogen flame ionization detector (FID). The FID actually measured non-methane organic compounds rather than non-methane hydrocarbons. This deficiency in the methodology was recognized by EPA, but it was the best available method at the time.

Federal vehicle emission control standards were initiated in 1968. In addition to vehicle emission controls, states began to focus on reducing emissions of volatile organic compounds from stationary sources. Control measures focused on facilities handling volatile organic liquids, organic solvent users, and architectural coatings.

EPA defined volatile organic compounds in their emission rules as “any compound containing carbon and hydrogen or containing carbon and hydrogen in combination with any other element which has a vapor pressure of 1.5 pounds per square inch absolute (77.6 mm Hg) or greater under actual storage conditions.”

In 1975, data showed exceedances of ozone standards in rural eastern areas and transport of ozone away from urban areas. EPA modified its volatile organic compound control policies. EPA began focusing on reducing precursor emissions of volatile organic compounds, and emphasized all reactive organic compounds should be controlled.

In January 1976, EPA published a “Policy Statement on Use of the Concept of Photochemical Reactivity of Organic Compounds in State Implementation Plans for Oxidant Control”. This listed the need for all states to have control measures to reduce all volatile organic emissions.

EPA issued multi-volume guideline documents for dealing with VOCs from surface coating operations (1976-77). EPA reaffirmed its desire to reduce volatile organic emissions irrespective of photochemical reactivity. EPA recommended a uniform definition of VOCs in coating operations as “any compound of carbon (excluding some stated compounds) that has a vapor pressure greater than 0.1 mm of Hg at standard conditions.” For coating operations, mass balances were listed as the best method for quantifying emissions of VOCs.

For add-on treatment, EPA suggested emission limits be based on control device destruction deficiency for combustible carbon. There were no universally accepted methods for quantifying VOCs. EPA thought incinerators should be able to achieve a 90% reduction of non-methane volatile organic compounds (VOC measured as total carbon).

Since it was generally impractical to quantify the mass of VOCs, source VOC testing would be conducted with methods employing FID detectors or total carbon analysis. EPA felt states should develop standards in terms of carbon rather than total mass, but recognized that results may not be representative of true volatile organic mass.

EPA began to develop New Source Performance Standards to reduce VOC emissions. The focus was on emissions from storage vessels containing organic liquids.

EPA revised the standards for photochemical oxidants in 1979 to be specific to ozone. The level of the standard was increased from 0.08 ppm to 0.12 ppm. States were required by EPA to use one of identified emission reduction options to meet the new ozone standard. These options included dispersion modeling, empirical kinetics modeling, and statistical modeling.

EPA issued a document in 1980 called “Facts and Issues Associated with Need for Hydrocarbon Criteria Document”. EPA concluded ambient non-methane hydrocarbon standard should no longer be used to meet the ambient ozone standard. The hydrocarbon standard was repealed in 1983.

In 1986, EPA restructured requirements in SIP's for attainment of ambient air quality standards. EPA deleted the 1971 definition of volatile organic compounds – described earlier. EPA

modified its definition of VOC to include photochemical reactivity. EPA told states to no longer include vapor pressure cutoff of 0.1 mm Hg for defining VOCs. This was proposed in a 1983 rulemaking and made final in 1989.

New Source Performance Standards were proposed to limit VOCs from new sources between 1980 and 1983. Test methods were needed to determine compliance with these standards. Method 24 was issued in 1980 to VOC content of coatings. Method 25 was issued in 1980 for determining VOC content of vent gasses, followed by Method 25A, Method 25B and Method 18 and Method 21 in 1983. Different methods produced varying results. In each NSPS, EPA specified which method should be used for the circumstances.

EPA expressed its preference during this time for a reference method involving indirect measurement of VOCs by oxidation-reduction procedure, excluding methane (later became EPA Method 25).

The 1990 Clean Air Act Amendments contained VOC control technique guidance. In 1992, EPA issued the definition of VOC to be “any compound of carbon, excluding some specified compounds, which participates in atmospheric photochemical reactions.” The definition excludes organic compounds, which were shown to have negligible photochemical reactivity.

This new VOC definition replaced the definition previously adopted by EPA in 1989. Since 1992, EPA’s definition has not changed, but additional compounds have been excluded because they have been found to have negligible photochemical reactivity. Ethane was used as the benchmark. Only compounds with lower reactivity than ethane were excluded from VOC definition.

EPA began working on Maximum Achievable Control Technology Standards (MACT). These standards focused on the 189 Hazardous Air pollutant list. About 100 of these were also Volatile Organic Compounds, like methanol. EPA realized there were too many hazardous air pollutant mixtures being emitted at sources, and reliable measurement methods were not available. EPA used surrogate parameters, which was usually total organic compounds, with the emission limits expressed in terms of the surrogate. This allowed EPA to use already established test methods for various sources.

In 1996, EPA promulgated an NSPS for municipal solid waste (MSW) landfills. EPA designated non-methane organic compounds as a surrogate for MSW landfill emissions. EPA specified two test methods (Method 18 or new Method 25C for measurement).

EPA Office of Air Quality Planning/Standards Guidance on VOCs: The EPA OAQPS offered the following guidance to all EPA Regional Offices in June, 2001 on reporting of VOC emissions. For both New Source Review and for Title V applicability, VOC emissions should be calculated as total mass of VOCs. Each compound should be calculated separately and total reported as total VOCs. Those substances excluded from definition of VOCs should not be included in total mass. When species are unknown, emissions should be calculated using an educated guess or a molecular weight of 44 (for reporting as propane).

EPA Region VI office guidance in December 2001 for a medium density fiberboard plant required all VOC mass emission rates be reported. The facility was to include mass emissions of formaldehyde and methanol with the mass emissions of terpenes measured by Method 25A. The formaldehyde and methanol was to be added back into the equation for total VOCs.

SOME CURRENT STATE GUIDANCE ON VOC METHODOLOGY

EPA guidance on VOC measurement remains somewhat undefined. In 1991, EPA issued the “Manual for Coordination of VOC Emissions Testing Using EPA Methods 18, 21, 25, and 25A”. Differences between test methods were described. Many states have differing opinions on how VOCs should be reported. Listed below is a summary of some states' guidance on VOCs.

South Carolina Guidance on VOCs: South Carolina Dept. of Health and Environmental Control received guidance from EPA Region IV in 1996 letter, that VOC emissions should be expressed as total mass of VOCs for permitting and for emission fees. If measuring only carbon, then emissions must be adjusted by multiplying emission rate of carbon by VOC-to-carbon weight ratio in exhaust stream. If this is not known, additional stack testing must be done to measure VOCs in exhaust stream directly. No guidance was provided on how to do this.

Oregon Guidance on VOCs: State of Oregon Department of Environmental Quality received guidance from EPA Region X in 1999 on VOC emissions. This guidance stated that for new source review and Title V applicability, emissions must be calculated as total mass of VOCs. For determining compliance with source category emission limits, VOCs can be reported according to test methods in approved SIP's. Oregon is working on guidance for testing of VOC from wood panel plants. Latest draft of guidance is December 2001. This guidance suggests that Method 25A (VOCs as propane) be used for sampling dryer emissions, which mostly contain terpenes. In addition, separate testing of formaldehyde and methanol would have to be conducted and added back to results of Method 25A testing as propane. For dryers firing natural gas, exhaust streams should be tested for methane and ethane so they can be subtracted from Method 25A results. For press vents, Method 25A should be done and results added to testing for methanol and formaldehyde.

North Carolina Guidance on VOCs: The State issued guidance in 1996 on quantifying and controlling VOCs on a mass emission as VOC basis.

Texas Guidance on VOCs: Texas continues to use guidance from discussions from 1993-1997. This is that VOC measurements be based on Method 25A for the forest products industry. If appropriate, Method 18 could be used in certain circumstances.

Pennsylvania Guidance on VOCs: Pennsylvania published a Source Testing Manual in November 2000 that stated the following guidance. If VOC emissions are unknown, results should be reported in terms of propane. If composition of gas stream is known and a single VOC constitutes more than 75% by volume of total emissions, then emissions must be reported in terms of that compound.

If composition of gas stream is known, and a single VOC does not constitute more than 75% by volume of total emissions, then emissions must be reported in terms of a department approved surrogate. If results are to be reported as VOCs, then speciation of exempted compounds is necessary.

FINDINGS/CONCLUSIONS

The findings/conclusions of the VOC subcommittee were:

1. There is a number of EPA approved VOC methods capable of quantifying VOCs, including engineering approaches such as material balances.
2. Due to the wide range of industries and types of emissions from sources within an industry, it is technically difficult to specify any one single method for VOC measurement (see Appendix).
3. Most permits don't specify VOC test methodology for purposes of demonstrating compliance with VOC limits.
4. VOC test results are used for a variety of purposes: 1) emission fees, 2) new source review applicability, 3) compliance with permit limits and control efficiencies.
5. There is a wide range of approaches to VOC testing being used by various states. There is inconsistencies and lack of guidance among states and EPA regions in implementation of VOC test methodology.

RECOMMENDATIONS

The VOC subcommittee recommends that:

1. VADEQ adopt Pennsylvania state guidance for quantifying VOCs published in that State's November 2000 Source Testing Manual. This guidance states that, if VOC emissions are unknown, results should be reported in terms of propane. If composition of gas stream is known and a single VOC constitutes more than 75% by volume of total emissions, then emissions must be reported in terms of that compound. Otherwise, emissions must be reported in terms of a department approved surrogate. If results are to be reported as VOCs, then speciation of exempted compounds is necessary.
2. When one component of VOCs constitutes more than 75% of the exhaust stream and VOCs get reported as that compound, DEQ should inquire about similar industries in state to assure consistency of choosing surrogates (like Oregon did for all wood panel plants).
3. All air permits get written with the VOC compliance methodology stated in the permits. This protects both the source and DEQ in compliance certifications.

4. VADEQ develop a database on their web page listing all surrogate parameters chosen for VOC reporting - by industries - to assure consistency across industries and DEQ regional offices.

APPENDIX
Summary of Selected Regulatory VOC Testing Requirements

Source Category	Regulatory Citation	Emission Limits	Test Methods	Regulatory Details	Definitions
40 CFR Part 60 New Source Performance Standards					
Kraft Pulp Mills	Subpart BB	See 60.283	Method 16	VOC is regulated by the standard as Total reduced sulfur (TRS).	Total reduced sulfur (TRS) means the sum of the sulfur compounds hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, that are released during the kraft pulping operation and measured by Method 16.
Automobile and Light Duty Truck Surface Coating Operations	Subpart MM	See 60.392	Method 24 (no capture/ control system)	<i>Facility does not use a capture and control system:</i> The owner or operator shall determine the composition of the coatings by formulation data supplied by the manufacturer of the coating or from data determined by an analysis of each coating, as received, by Method 24. [60.393(c)(1)(i)].	VOC content means all volatile organic compounds that are in a coating expressed as kilograms of VOC per liter of coating solids.
			Method 25 (capture/ control system)	<i>Facility using a capture and control system:</i> Determine VOC applied per 60.393(c)(1)(i). Determine the destruction efficiency of the control device using values of the volumetric flow rate of the gas streams and the VOC content (as carbon) of each of the gas streams in and out of the device by the following equation... [60.393(c)(2)(ii)(B)]. Must use Method 25 [60.396 (a)(2)]	
Industrial Surface Coating: Large Appliances	Subpart SS	See 60.452	Method 24 (for the coating itself) Method 25 (for TOC concentration in air)		

Polymer Manufacturing Industry	Subpart DDD	See 60.561-1 for Process Vents	Method 18	Compliance with the emission standards are generally determined using Method 18. However, some compliance options, such as combusting in a boiler exceeding 150 MMBTU/hr do not require testing	Volatile organic compounds (VOC) means, for the purposes of these standards, any reactive organic compounds as defined in 60.2 Definitions.
Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Unit Processes	Subpart III	See 60.612	Method 18	Compliance with the emission standards are generally determined using Method 18. However, some compliance options, such as combusting in a boiler exceeding 150 MMBTU/hr do not require testing.	Total organic compounds (TOC) means those compounds measured according to the procedures in 60.614(b)(4).
Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations	Subpart NNN	See 60.662	Method 18	Applies to non-batch, continuous process that distill chemicals listed at 60.667	
40 CFR Part 63 MACT Standards					
Pulp and Paper Industry	Subpart S	See 63.443 - 63.447	Method 308 (Methanol) for process vents	63.457(f) allows compliance with 63.443, 63.444, and 63.447 to be demonstrated based on Total HAP equal to the sum of all individual HAP OR based on Total HAP as methanol. 63.457(h) allows compliance with 63.445 to be demonstrated based on Total HAP equal to the sum of all chlorinated HAP OR based on Total HAP as chlorine. 63.457(g) allows compliance with 64.446 to be demonstrated as methanol (for non-bio systems) or the sum of acetaldehyde, methanol, MEK and propionaldehyde (for bio systems).	
			Method 26A (Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources-Isokinetic Method) for process vents		
			Method 305 (Measurement of Emission Potential of Individual Volatile Organic Compounds in Waste) for wastewaters, process waters, and condensates		
			Method 21 for fugitive equipment leaks		

Pesticide Active Ingredient Production	Subpart MMM	See 63.1362 - 63.1363	See 63.1365		
			Method 18 for process vents		
			Method 25 for process vents		
			Method 26 for process vents		
			Method 25 D (Determination of the Volatile Organic Concentration of Waste Samples) for wastewater		
			Method 305 (Measurement of Emission Potential of Individual Volatile Organic Compounds in Waste) for wastewaters		
			Method 624 (Volatiles) and 625 (Extractables) for wastewater		
			Method 1624 and 1624 for wastewater (same as 624/625 except use GC/MS detection)		
			Method 21 for equipment leaks		

Synthetic Organic Chemical Manufacturing Industry Process Vents, Storage Vessels, Transfer Operations, and Wastewater (HON)	Subpart G	See appropriate sections of Subpart G	Method 18 (for compliance with the 20 ppmv option or the 98 percent reduction option for process vents)		
			Method 26 or 26A (compliance option for combustion device followed by a scrubber or other halogen reduction device to control halogenated vent streams for process vents)		
			Method 18 or 25A (compliance with the 20 ppmv option or the 98 percent reduction option for transfer operations)		
			Method 305 (Measurement of Emission Potential of Individual Volatile Organic Compounds in Waste) for wastewaters		
			Method 21 for equipment leaks		